AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (currently amended) A method of manufacturing a joint by operating a riveting system having a riveting tool, a self-piercing rivet, and automotive vehicle panels, the riveting tool including an electric motor and a rivet punch, the method comprising:

(a) determining if the self-piercing rivet is located in the riveting tool;

(b) moving the self-piercing rivet to the riveting tool if step (a) is negative;

(c) energizing the electric motor to advance the self-piercing rivet;

(d) rotating a portion of the electric motor in response to step (c);

(e) converting the rotation of step (d) to linear displacement of the rivet punch;

(f) the rivet punch pushing against a solid head of the self-piercing rivet during insertion into the automotive vehicle panels;

(g) advancing the self-piercing rivet into an unpierced portion of the automotive vehicle panels, in response to step (e), without fluid actuation in the riveting tool;

(h)[[(g)]] outwardly diverging a leading end of the self-piercing rivet during insertion of the self-piercing rivet into the automotive vehicle panels;

(i)[[(h)]] preventing the self-piercing rivet from completely piercing through a die side one of the automotive vehicle panels; and

(j)[[(i)]] determining displacement associated with the rivet punch as a function of actuation speed used to insert the self-piercing rivet.

2. (original) The method of claim 1 further comprising deenergizing the electric motor and transmitting an error signal if an unacceptable condition is determined.

3. (original) The method of claim 1 further comprising clamping the automotive vehicle panels together in an area substantially surrounding the riveting area.

4. (original) The method of claim 1 further comprising the rivet punch pushing against a solid head of the self-piercing rivet during insertion into the automotive vehicle panels.

5. (currently amended) The method of claim 1 further comprising comparing [[the]] real-time sensed displacement associated with the rivet punch to prestored displacement values.

6. (original) The method of claim 1 further comprising automatically moving a C-frame by a robotic arm, the riveting tool being attached to the C-frame.

7. (currently amended) A method of manufacturing a joint by operating a riveting system having a riveting tool, a C-frame, a die, a self-piercing rivet, and automotive vehicle panels, the riveting tool including an electric motor and a rivet punch, the method comprising:

(a) robotically moving the C-frame to align a joint area of the automotive vehicle panels between the rivet punch and the die;

(b) inserting a self-piercing rivet to the riveting tool;

(c) rotating a portion of the electric motor;

(d) linearly moving the rivet punch in a fluid-free manner;

(e) clamping the automotive vehicle panels together in an area substantially surrounding the joint area;

(f)[[(e)]] punching the self-piercing rivet into a solid portion of the automotive vehicle panels;

(g)[[(f)]] using the die to outwardly diverge a leading end of the self-piercing rivet during insertion of the self-piercing rivet into the automotive vehicle panels, always keeping the rivet punch and die coaxially aligned during use of the riveting tool;

(h)[[(g)]] preventing the self-piercing rivet from completely piercing through a die side one of the automotive vehicle panels; and

(i)[[(h)]] sensing real-time velocity of a component coupled to at least one of: the electric motor and the rivet punch.

8. (original) The method of claim 7 further comprising deenergizing the electric motor and transmitting an error signal if an unacceptable condition is determined.

9. (original) The method of claim 7 further comprising clamping the automotive vehicle panels together in an area substantially surrounding the joint area.

10. (original) The method of claim 7 further comprising the rivet punch pushing against a solid head of the self-piercing rivet during insertion into the automotive vehicle panels.

11. (original) The method of claim 7 further comprising comparing real-time sensed displacement associated with the rivet punch to prestored displacement values.

12. (original) The method of claim 7 further comprising always keeping the rivet punch and die coaxially aligned during use of the riveting tool.

13. (currently amended) A method of manufacturing by operating a riveting system including an electric motor, a belt, a transmission, a punch, a die, a workpiece clamp, a C-frame, and a self-piercing rivet, the method comprising:

(a) stationarily attaching the die to the C-frame;

(b) sensing if the self-piercing rivet has been fed adjacent to the punch;

(c) rotating a portion of the electric motor;

(d) rotating the belt in response to rotation of the electric motor;

(e) rotating a portion of the transmission in response to rotation of the belt;

(f) linearly displacing the punch in response to rotation of the portion of the transmission;

(g) linearly advancing the workpiece clamp;

(h) using the punch to directly contact against and linearly push a solid head of the self-piercing rivet;

(i) using the die to outwardly diverge a leading end of the self-piercing rivet while preventing the self-piercing rivet from contacting directly against the die, always keeping the rivet punch and die coaxially aligned during use of the riveting tool;

(j) sending a signal between a computer controller and a sensor, and the sensor sensing a characteristic associated with the electric motor; and

(k)[[(j)]] electronically comparing a sensed and real-time action associated with operation of at least one of: the electric motor, the transmission, and the punch, to at least one pre-programmed value.

14. (original) The method of claim 13 further comprising deenergizing the electric motor and transmitting an error signal if an unacceptable condition is determined.

15. (original) The method of claim 13 further comprising clamping a pair of aluminum, automotive vehicle panels together in an area substantially surrounding the riveting area.

16. (original) The method of claim 13 further comprising inserting the self-piercing rivet into an unpierced area of automotive vehicle panels to be joined.

17. (original) The method of claim 13 further comprising automatically sensing and automatically comparing real-time values associated with the punch to prestored values, the values being a function of at least one of: displacement and speed.

18. (original) The method of claim 13 further comprising robotically moving the C-frame to align a joint area of automotive vehicle panels to be joined

between the punch and the die, a rotational axis of the electric motor being offset from an elongated axis of the punch.

19. (original) The method of claim 13 further comprising sending a signal between a computer controller and a sensor, and the sensor sensing a characteristic associated with at least one of: the punch and the transmission.

20. (original) The method of claim 13 further comprising sending a signal between a computer controller and a sensor, and the sensor sensing a characteristic associated with the electric motor.

21. (new) A method of riveting automotive vehicle workpieces with a riveter, a frame, a die, and a self-piercing rivet, the method comprising:

(a) robotically moving the frame to align a joint area of the automotive vehicle panels between a rivet driver of the riveter and the die, the rivet punch and die always being coaxially aligned during use of the riveter;

(b) supplying the self-piercing rivet to the riveter;

(c) rotating a portion of an electric motor of the riveter;

(d) linearly moving the rivet driver in a fluid-free manner in response to step (c);

(e) clamping the automotive vehicle workpieces together adjacent a solid portion of the automotive vehicle workpieces to be riveted;

(f) pushing the self-piercing rivet into the solid portion of the automotive vehicle workpieces;

(g) outwardly diverging a leading end of the self-piercing rivet, with the die, during insertion of the self-piercing rivet into the automotive vehicle workpieces;

(h) preventing the self-piercing rivet from completely piercing through a die side one of the automotive vehicle workpieces; and

(i) sensing a real time value of the electric motor during riveting operation and automatically comparing the real time value to a desired, stored value.